Summary of "The Effect of Age Upon Specialty Care in Patients Hospitalized for Congestive Heart Failure in Alberta"

By: H. Quan, Y. Jin, B. Cujec, and D. Johnson

Purpose

Aging of the population presents a challenge to policy makers and health care professionals who manage the delivery of health care services. Heart failure is a common reason for hospital admission, which may be related to an aging population. Therapy for heart failure includes specialist care, drugs and in certain patients increasing the blood flow to the heart. This study investigates if the use of special care for heart failure was evenly distributed in all age groups of patients with heart failure.

Approach

Four Alberta administrative health services databases were used during a six-year time period (April 1, 1994 until March 31, 2000).

Key Findings

The following are the key findings:

- During the six years of the study, there were 16,162 patients hospitalized for newly diagnosed heart failure.
- Seniors (age sixty-five years and older) constituted about eighty-five percent of patients.
- The proportion of hospitalizations for heart failure in those eighty-five years and over was thirteen percent in 1994/1995 and increased to eighteen percent in 1999/2000.
- The frequency of other diseases and the severity of heart failure increased with age.
- Mortality was significantly greater in those seventy-five years and older compared to patients less than seventy-five years old.
- The proportion of specialist care decreased with age.
- The use of intensive care, tests to visualize the blood flow to the heart, procedures to increase the blood flow to the heart peaked in the fifty to sixty-four year age group and decreased with increasing age.
- Prescriptions of specific drugs for heart failure decreased with age in seniors.
- Total hospital costs were lower in the elderly despite a longer length of hospital stay.

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Conclusions

Outcomes and care received in patients with heart failure varied with age. New diagnosis of heart failure increased with age. The elderly had greater mortality but received less therapy. The lower use of health services and resources allocation in those with greater severity of illness and mortality may seem counter-intuitive. However patients or their physicians may choose different medical care based upon age or debilitating conditions.

Choices about appropriate medical care vary over time, and, in future, an increased utilization of special medical care may occur for even the oldest patients. The pivotal unanswered question for clinicians and those that fund the provision of health services is "Would more aggressive medical therapy similar to that for younger patients have decreased the higher mortality in older patients?" The potential benefit that could be derived from more aggressive therapy in the very old is unknown.

For More Information

Copies of the report are available from the

Alberta Centre for Health Services Utilization Research

- by contacting David Johnson by e-mail at cujecjohnson@shaw.ca
- at http://www.health.gov.ab.ca/system/key/Research/achsur_reports.html

Alberta Centre for Health Services Utilization Research

The Alberta Centre for Health Services Utilization Research is a joint initiative between the University of Alberta and the University of Calgary, funded by Alberta Health and Wellness. The Centre conducts studies of how health services are used and delivered to inform health policy development and management of health services delivery.

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The Effect of Age Upon Specialty Care in Patients Hospitalized for Congestive Heart Failure in Alberta

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SUMMARY

An increase in hospitalization for congestive heart failure may be related to an aging population. We describe the age-specific outcomes for patients hospitalized with newly diagnosed congestive heart failure using administrative hospital abstracts from Alberta during April 1, 1994 to March 31, 2000.

We found that during the six years of the study there were 16,162 patients hospitalized for newly diagnosed congestive heart failure. Seniors (age sixty-five years and older) constituted about eighty-five percent of patients. Both comorbidity and severity of illness tended to increase with age. The use of special care unit admissions, coronary artery diagnostic services (cardiac catheterization), and revascularization procedures (percutanenous transluminal coronary angioplasty / stenting, coronary artery bypass surgery) peaked in the fifty to sixty-four year age group and decreased with increasing age. Prescriptions of beta blockers and angiotensin converting enzyme inhibitors and receptor blockers decreased with age in seniors. The proportion of specialist care decreased with age. Adjusted in-hospital, one-year mortality and crude age-specific five-year mortality were significantly greater in those seventy-five years and older compared to patients less than seventy-five years old.

We concluded that outcomes and process of care in patients with newly diagnosed congestive heart failure were not uniformly distributed with age. The elderly had greater mortality but received less therapy. The pivotal unanswered question for clinicians, policy makers, and those that fund the provision of health services is: "Would more aggressive medical therapy similar to that for younger patients have decreased the higher mortality in older patients?"

INTRODUCTION

Aging of the population presents a challenge to policy makers and health care professionals charged with ensuring the delivery of comprehensive, high quality programs and services to older persons over the coming decades. Congestive heart failure is the most common diagnosis for hospital admission in the United States [1] and other industrialized countries [2-6]. The increase in congestive heart failure hospitalization may be related to demographic changes in an aging population or related to enhanced survival from acute ischemic heart disease (the most common cause of congestive heart failure) [1, 8, 9]. Despite the increased prevalence, mortality has declined suggesting recent therapy may have improved outcome [10, 11]. The innovations in therapy include pharmacological and revascularization [10, 12] which have also been accompanied by the increased use of diagnostic procedures [13, 14]. Improved outcomes in patients with congestive heart failure may not be uniformly distributed with age in that the elderly receive less therapy despite having a worse prognosis [15, 16].

In this study, we use administrative data from one Canadian province to assess the incidence and prevalence of congestive heart failure in seniors during a six-year time period (April 1, 1994 until March 31, 2000). The age-specific use of diagnostic health services (internal medicine specialist / subspecialist care and cardiac catheterization), therapeutic health services (percutanenous transluminal coronary angioplasty / stenting, coronary artery bypass surgery, discharge prescriptions of beta blockers and angiotensin converting enzyme inhibitors / receptor blockers) in the year following the initial hospital diagnosis of congestive heart failure was described. One-year and Five-year age-specific mortality following the initial hospital diagnosis of congestive heart failure was also described. We hypothesize that the utilization of hospital services varies amongst age groups and that the very old may have preferential low utilization.

METHODS

Four administrative health service databases were used and the analysis was done within the protected environment of Alberta Health and Wellness, which is governed by provincial legislative guidelines on the confidentiality of health information.

1. Canadian Institute for Health Information's (CIHI) Inpatient Discharge Abstract Database (DAD) for the province of Alberta for fiscal years 1992/1993 to 1999/2000,
2. Alberta Health Insurance Plan Registry File for fiscal years 1994/1995 to 1999/2000,
3. Alberta Physician Claims Assessment System Database for 1992/1993 to 1999/2000, and
4. Alberta Blue Cross Insurance plan for fiscal years 1994/1995 to 1999/2000.

Study Population:

Inclusion Criteria:

1. Congestive heart failure (CHF) was defined using the fifteenth International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM 428.x, 398.91, 402.x1, 404.x greater than 0, 514.x, 518.4, 425.9) in the most responsible diagnosis field of the CIHI DAD hospital abstract [17], and
2. Office or ambulatory care internal medicine specialist consultation claim (CPX 03.x) [18] for congestive heart failure as defined by ICD-9-CM above.

Exclusion Criteria:

1. Not an Alberta resident,
2. Age < 20 or age > 105,
3. Not admitted to an Alberta acute care facility,
4. No hospitalization for congestive heart failure (as the most responsible diagnosis) during the two years prior to index encounter, and
5. No duplicate separations within the five study years.
6. No previous internal medicine specialist consultation claim for congestive heart failure (defined as for hospitalizations) as the most responsible diagnosis during the two years prior to index encounter.

Prevalence was defined as unique Alberta patients hospitalized in Alberta during each year of the study period. Prevalence included both incident cases and all other patients hospitalized for congestive heart failure for each study year. Total hospitalizations were defined by counting all hospitalizations in Alberta for Alberta patients for each year of the study period.

Covariates:

Patient Characteristics:

1. Age (20 to 49, 50 to 64, 65 to 75, 75 to 84, and 85 and over),
2. Sex (female versus male),
3. Year of congestive heart failure separation,
4. Region of residence (seventeen health regions in Alberta were grouped into two metropolitan regions, Calgary, Edmonton and one non-metropolitan region),
5. Export (admission to a hospital located in a region not within region of residence),
6. Resident of continuing care prior to hospital admission, and
7. Transfer to another acute care hospital.

Severity of Disease:

The seventeen comorbidities that constitute the Charlson index [19, 20] were defined using Deyo's coding algorithm and the fifteen supplemental diagnosis fields in the CIHI DAD hospital abstract. The Charlson comorbidities were aggregated into none, one, and two or more of the individual conditions. Polanczyk's comorbidities [21] were defined as:

1. Anemia (ICD-9-CM 280.xx to 285.xx),
2. Hyponatremia and other electrolyte disturbance (ICD-9-CM 276.x),
3. Coronary artery disease (ICD-9-CM 411.xx, 413.xx, 414.xx),
4. Hypertension (ICD-9-CM 401.xx to 405.xx),
5. Valvular heart disease (ICD-9-CM 394.xx to 398.xx, 424.xx),
6. Ventricular arrhythmia (ICD-9-CM 427.4x, 427.5x, 427.6x), and
7. Hypotension and shock (ICD-9-CM 458.xx, 785.5x),

We also recorded:

1. Transfers to another acute care hospital (all outcomes attributed to first hospital contact),
2. Special care unit admission (hospital defined), and
3. Cardiac catheterization (see below). A severity score [21] was defined and assigned to each patient using the following weighting method: one point per decade of age greater than forty years and two points for each of transferred admission, cerebral vascular disease, chronic obstructive lung disease, hyponatremia, other electrolyte disturbance, metastatic disease) and four points for moderate to severe renal disease and six points for ventricular arrhythmia, mild liver disease, or malignancy) and thirteen points for hypotension or shock.

Health services associated with congestive heart failure in the year following initial diagnosis were:

1. Cardiac catheterization (Physician claims CPX 48.92A, 48.98A, 48.98B, 49.96A, 49.96B),
2. Percutaneous transluminal coronary angioplasty / stenting (Physician claim CPX 51.59C), and
3. Coronary artery bypass surgery (Physician claims CPX 48.0 A, 48.12, 48.12A, 48.13, 48.13A, 48.14, 48.14A, 48.15A, 48.15B, 48.15C, 48.15D, 48.15E, 48.15F, 48.15G, 48.15H, 48.19A).

Prescriptions:

Seniors registered with the Alberta Health Care Insurance received subsidized prescriptions with Alberta Blue Cross. Anonymous patient identifier for each prescription was merged with the prescription database identifying each drug identification number and classifying these drugs as either beta blockers or angiotensin converting enzyme (ACE) inhibitor or receptor blocker. Any prescription within three months after hospital discharge was identified. Use of either drug was assumed if any prescription was linked after the initial diagnosis of congestive heart failure was made.

Hospital Volume:

At the time of this study, an autonomous regional board in each of the seventeen health regions administered all hospitals in Alberta. Nearly all of the three million residents of Alberta enrolled in the public health care insurance plan reside in one of the seventeen health regions. Alberta hospitals admitting congestive heart failure patients were categorized into five groups on the basis of the total number of congestive heart failure separations between April 1, 1994 until March 31, 2000 and geographic location.

1. Rural hospitals were based on the fiftieth percentile volume in rural areas,
2. Seventy-seven hospitals had less than 200 cases and twenty-five hospitals had 204 to 646 cases,
3. Regional hospitals (five) located in one of the five non-metropolitan regional health care cities had 238 to 646 cases,
4. Metropolitan hospitals (six) located in the metropolitan health region of Calgary and Capital without angiography capability had 327 to 2,199 cases, and
5. Metropolitan hospitals (three) located in the metropolitan health regions of Calgary and Capital with angiography capability had 1,793 to 2,700 cases.

Congestive Heart Failure Outcomes:

Length of Stay:

Length of stay was calculated as days between discharge and admission date. Transfers between different hospitals were attributed to the index admission and cumulative hospital length of stay calculated for an episode of care. Discharges and admissions within twenty-four hours to the same hospital were counted as separate admissions. Length of stay in regressions were restricted to those discharged alive.

Hospital Costs:

In patient costing per resource group number (RGN – an Alberta refinement of Diagnosis Related Groups) was calculated using the provincially approved methodology as set forth by the Provincial Costing Project and in accordance with the Provincial and National Management Information Systems guidelines [22, 23]. Total costs combine allocation and assignment of all direct and indirect costs associated with an in patient encounter from the time a patient is admitted to the hospital to the time they are discharged. All costs per RGN were estimated using 1998/1999 costs and assumed similar for all the study years. All costs for episode of hospital care were attributed to the index separation. The quality of the data reporting of costs in Alberta has been highly ranked by the Canadian Institutes for Health Information [24]. As such, the methodological issues that arise around collection of cost data in the United States [25], in part due to the use of prices rather than costs, and for centres in Canada which cost admissions on the basis of "case-mix grouping" do not arise with the majority of the cost data considered in this analysis.

180-Days Readmission to Hospital:

First readmission to any acute care hospital within 180 days for those alive at hospital discharge for congestive heart failure.

Mortality:

Vital statistics declaration of death certificates were merged with the Alberta Health and Wellness Premium Registry databank in order to determine de-registration from the plan. One-year and five-year mortality consisted of deaths after date of admission but excluded in-hospital deaths unless otherwise stated.

STATISTICS

Age-specific mortality and the ninety-nine percent confidence intervals were calculated for patients diagnosed in 1994/1995 with congestive heart failure and followed for five years post diagnosis. The 1999/2000 provincial population and age at the fiscal year-end were used for rate calculations. Incident patient cohorts diagnosed at time of hospitalization or during ambulatory specialist office visits were mutually exclusive. The mortality for the 1994/1995 general Alberta population without a diagnosis of congestive heart failure was also calculated during the subsequent five years. For each the five follow-up years from the beginning date of April 1, 1994, all surviving patients or those in the general population were registered in the Alberta Health Insurance Plan Registry File.

Age specific incidence, prevalence, and cumulative hospitalizations as defined above were calculated. The age at the fiscal year end was used for rate calculations. Age-specific cumulative incidence rate and ninety-nine percent confidence interval during April 1, 1994 to March 31, 2000. For rate calculations, the mid 1998/1999 population was used (average of 1998/1999 and 1999/2000).

Bivariate and multivariate comparisons were done by chi-square and differences in variance as appropriate. Adjusted mortality and readmission rates were calculated using logistic regression and observed to expected ratios. We averaged these predicted probabilities in a given year (E). The observed rate of outcome (O) divided by the expected rate (E) generated an O / E ratio for each year. The adjusted rates of outcome were calculated by multiplying each year's O / E ratio by the overall outcome rate. Adjusted length of stay and hospital costs per day were calculated using multiple regression and least-square means. Covariates used for multiple regression adjustment included patient characteristics, severity of illness, comorbidity, and hospital volumes. In the analysis of length of stay, hospital costs, and readmission, in-hospital deaths were excluded. Modeling used SAS (Version 6.12) [SAS Institute Inc. Cary, NC 2000] and significance was defined as $p < 0.05$.

RESULTS

During the six years of the study, there were 16,162 hospitalizations for newly diagnosed congestive heart failure (incidence cases), representing about fifty percent of the 32,139 total hospitalizations for congestive heart failure during this period of time. Patients with incident congestive heart failure in the previous study years (prevalence cases) constituted seventy-five of the total hospitalizations. The cohort of patients with newly diagnosed congestive heart failure was predominately elderly (mean age equals 75.9 years) compared to the mean age of forty-four years in the 1998/1999 general

population of adults in Alberta. Seniors (age sixty-five years and older) constituted about eighty-five of all new diagnosis for congestive heart failure. The hospitalizations were not uniformly distributed amongst the five age groups with those aged seventy-five years and over constituting about sixty percent of all incident, prevalent, and total hospitalization cases. The incident (hospitalized and ambulatory), prevalent, and total hospitalization rates for congestive heart failure significantly increased with age (Figures 1 and 2). The proportion of incident hospitalizations for congestive heart failure in those eighty-five years and over was thirteen percent in 1994/1995 and increased to eighteen percent in 1999/2000 ($p < 0.000$). The proportion of incident congestive heart failure diagnosis for ambulatory patients in those eighty-five years and over was 9.6 percent in 1994/1995 and increased to 10.6 percent in 1999/2000 ($p < 0.000$).

The percent of women and non-metropolitan residents with heart failure increased with age (Table 1). Those patients sixty-five years and older tended to be admitted into a hospital located within their region of residence more frequently. The admission hospital for those sixty-five years and over tended to be more frequently rural and less patients aged sixty-five years and older were admitted into a hospital with angiography capability. Overall about sixty-five percent in the entire cohort had one or more than one comorbidity. Both comorbidity and severity of illness tended to increase with age. (Table 2) The use of special hospital services (special care unit admission), coronary artery diagnostic services (cardiac catheterization), and revascularization procedures (percutanenous transluminal coronary angioplasty / stenting, coronary artery bypass surgery) peaked in the fifty to sixty-four year age group and decreased with increasing age (Table 3). Specialist consultants provided care more frequently in younger patients and the most responsible hospital physician was more often a general / family practice physician in older patients. Pharmaceutical prescription data after discharge were only available in seniors. Prescriptions of beta blockers and angiotensin converting enzyme inhibitors and receptor blockers decreased with age.

Tables 4 and 5 show un-adjusted and adjusted outcomes for newly diagnosed congestive heart failure. Crude and adjusted length of hospital stay was significantly longer in those seventy-five years and older. Hospital readmissions tended to increase with age but were not significantly different after adjustment for severity and comorbidity. Adjusted in-hospital and one-year mortality (excluding hospital deaths) were significantly greater in those seventy-five years and older. Total hospital costs and daily hospital costs significantly decreased with age.

Table 6 demonstrates the age-specific five-year survival for patients diagnosed with congestive heart failure from April 1, 1994 to March 31, 1995. We compared mortality in those diagnosed by admission to hospital and those diagnosed in an ambulatory setting to the age specific mortality in the general Alberta population. Ambulatory and hospitalized patients were mutually exclusive during the enrolment period. In general, mortality was greatest in those hospitalized for congestive heart failure followed by those in which a diagnosis was made during an ambulatory visit

to a specialist office and finally least in the general population without the diagnosis of congestive heart failure. The relative incremental increase in mortality ascribed to the diagnosis of congestive heart failure amongst these three cohorts decreased as age increased.

DISCUSSION

This study confirms previous reports that congestive heart failure is a disease of the elderly [9-11]. The incident rate for newly diagnosed congestive heart failure (in ambulatory or hospitalized patients) gradually increased with age. The predominance of elderly patients aged seventy-five years and older was noted for incident, prevalent and total hospitalization cases. The process of care and outcomes for older patients were different from that of younger patients. Despite greater severity of illness and comorbidity, older patients were less often admitted to special care units, seen by specialists as consultations or designated as most responsible physician, received investigations such as cardiac catheterizations, and were prescribed beta blockers or angiotensin converting enzyme inhibitors and receptor blockers on hospital discharge. Total hospital costs were lower in the elderly despite a longer length of hospital stay. The pivotal unanswered question in this study is: "Would more aggressive medical therapy similar to that for younger patients have decreased the higher mortality in older patients?" [26]. For pharmaceutical therapy the mortality reduction with use of beta blockers and angiotensin converting enzyme inhibitor / receptor blockers are generalizable to older patients with congestive heart failure [27-29].

The lower health service utilization and resource allocation in those with greater severity of illness and in-hospital mortality may seem counter-intuitive. However patients or their physicians may choose different medical care based upon age or debilitating comorbidity. Five years after the initial diagnosis of congestive heart failure, there was a mortality gap of forty-eight percent in those aged sixty-five to seventy-four years between the general population compared to those for hospitalized congestive heart failure patients (fifteen percent versus sixty-three percent). The five-year mortality gap decreased to twenty percent in those aged eighty-five plus years (sixty-nine percent versus eighty-nine percent). The diagnosis of congestive heart failure in the elderly (either in hospitalized or non-hospitalized patients) was associated with a high mortality in subsequent years. More aggressive therapy may not have altered outcomes even if provided to these older patients. The existing literature on outcomes of therapy for congestive heart failure may not be generalizable to the majority of patients with congestive heart failure. Clinical trials excluded patients older than seventy-five years and only enrolled patients with low ejection fractions [12] which was not present in fifty percent of older patients with the clinical diagnosis of congestive heart failure [30, 31].

Increased incident hospitalization for seniors with congestive heart noted in this study may be related to changing demographics in the population. Alberta has a relatively low

proportion of persons aged sixty-five plus years (9.3 percent in 1993 compared to 11.7 percent in Canada and 12.7 percent in the United States) [32]. The mean annual population growth in Alberta since 1990/1991 has been one percent in those less than sixty-five years and three percent in those aged sixty-five and over [33]. The projected proportion of those aged sixty-five and over in Alberta will be 13.5 percent in 2,016 [34]. The variation in medical services provided and hospital costs for different age groups has not been well described in the literature. Health care insurers will need to anticipate increased costs to treat congestive heart failure in the elderly especially if process of care changes to reflect greater health service utilization similar to that noted in younger patients. Canada spent the highest proportion of total health expenditures on seniors (48.9 percent) in 1993 compared to eleven other Organization for Economic Co-operation and Development countries. Alberta was close to the per capita expenditure of other Canadian provinces [34]. The average compounded growth in real provincial health expenditures solely due to population aging was 0.7 percent between 1980 and 1994. The average annual growth rate for total health expenditures in Alberta during the same time period was 2.1 percent [33]. Systematic age bias has been demonstrated for rehabilitation care, conservation therapy for breast cancer surgery, attempted suicide, heart failure, and health screening [35-39]. Choices about appropriate medical care vary over time, and, in future, an increased utilization of special medical care may occur for even the oldest patients. Such trends of increased utilization of health care services in an older population have already been noted for renal dialysis, organ transplantation, and coronary artery bypass surgery [40, 41].

This study has several limitations. Population-based administrative database research is highly generalizable although limited in clinical details. We attempted to adjust for case severity and comorbidity although these data may not have captured all of the important variation. The diagnosis of congestive heart failure from hospital discharge data may underestimate the true prevalence of this disease [42, 43]. We constructed an episode of care by attributing readmissions within the first day of discharge back to the original index admission. Our length of stay was attributed to the presenting hospital rather than all hospitals in which care could have been rendered.

In conclusion, we found the severity of illness, comorbidity, and mortality for congestive heart failure increased with age. In contrast, utilization of special medical services and hospital costs decreased with age (especially for those eighty-five years and over). The increased mortality attributed to congestive heart failure compared to the general Alberta population had less impact with increasing age. The potential benefit that could be derived from more aggressive therapy in the very old is unknown.

REFERENCES

1. Haldeman, G.A., Croft, J.B., Giles, W.H., and Rashidee, A, Hospitalization of Patients With Heart Failure: National Hospital Discharge Survey, 1985 to 1995, American Heart Journal, 1999; 137: 352-60

2. Murdoch, D.R., Love, M.P., Robb, S.D., McDonagh, T.A., Davie, A.P., Ford, I., Capewell, S., Morrison, C.E., and McMurray, J.J, Importance of Heart Failure as a Cause of Death Changing Contribution to Overall Mortality and Coronary Heart Disease Mortality in Scotland 1979 to 1992, European Heart Journal, 1998; 19: 1, 829-35

3. Ryden-Bergsten, T., and Andersson, F., The Health Care Costs of Heart Failure in Sweden. Journal of Internal Medicine, 1999; 246: 275-84

4. Mejhert, M., Persson, H., Edner, M., and Kahan, T., Epidemiology of Heart Failure in Sweden - a National Survey, European Journal of Heart Failure, 2001; 3: 97-103

5. Owen, A., and Cox, S., Diagnosis of Heart Failure in Elderly Patients in Primary Care, European Journal of Heart Failure, 2001; 3: 79-81

6. Stewart, S., MacIntyre, K., MacLeod, M.M., Bailey, A.E., Capewell, S., and McMurray, J.J., Trends in Hospitalization for Heart Failure in Scotland, 1990-1996, An Epidemic That has Reached its Peak? European Heart Journal, 2001; 22: 209-17

7. Philbin, E.F., and DiSalvo, T.G., Prediction of Hospital Readmission for Heart Failure: Development of a Simple Risk Score Based on Administrative Data, Journal of the American College of Cardiology, 1999; 33: 1, 560-6

8. Ali, A.S., Rybicki, B.A., Alam, M., Wulbrecht, N., Richer-Cornish, K., Khaja, F., Sabbah, H.N., and Goldstein, S, Clinical Predictors of Heart Failure in Patients With First Acute Myocardial Infarction, American Heart Journal, 1999; 138: 1, 133-9

9. McCullough, P.A., Philbin, E.F., Spertus, J.A., Kaatz, S., Sandberg, K.R., and Weaver, W.D., Resource Utilization Among Congestive Heart Failure (REACH) Study, Confirmation of a Heart Failure Epidemic: Findings From the Resource Utilization Among Congestive Heart Failure (REACH) Study, Journal of the American College of Cardiology, 2002; 39: 60-9

10. Polanczyk, C.A., Rohde, L.E., Dec, G.W., and DiSalvo, T., Ten-Year Trends In-Hospital Care for Congestive Heart Failure: Improved Outcomes and Increased use of Resources. Archives of Internal Medicine, 2000; 160: 325-32

11. Feldman, D.E., Thivierge, C., Guerard, L., Dery, V., Kapetanakis, C., Lavoie, G., and Beck, E.J., Changing Trends in Mortality and Admissions to Hospital for Elderly Patients With Congestive Heart Failure in Montreal, CMAJ, 2001; 165: 1, 033-6

12. Liu, P., Arnold, M., Belenkie, I., Howlett, J., Huckell V., Ignazewski, A., LeBlanc, M.H., McKelvie, R., Niznick, J., Parker, J.D., Rao, V., Ross, H., Roy, D., Smith, S.; Sussex, B., Teo, K., Tsuyuki, R., White, M., Beanlands, D., Bernstein, V., Davies, R., Issac, D., Johnstone, D., Lee, H., Moe, G., Newton, G., Pflugfelder, P., Roth, S., Rouleau, J., and Yusuf, S., Canadian Cardiovascular Society, The 2001 Canadian Cardiovascular Society Consensus Guideline Update for the Management and Prevention of Heart Failure, Canadian Journal of Cardiology, 2001; 17 Suppl E: 5E-25E

13. Gehlbach, S.H., Adamache, K.W., and Cromwell, J., Changes in the Use of Diagnostic Technologies Among Medicare Patients, 1985 and 1990, Inquiry. 1996-97; 33: 363-72b

14. Ashton, C.M., Petersen, N.J., Souchek, J., Menke, T.J., Pietz, K., Yu, H.J., and Wray, N.P., Rates of Health Services Utilization and Survival in Patients With Heart Failure in the Department of Veterans Affairs Medical Care System, American Journal of Medical Quality, 1999; 14: 55-63

15. Wolinsky, F.D., Overhage, J.M., Stump, T.E., Lubitz, R.M., and Smith, D.M., The Risk of Hospitalization for Congestive Heart Failure Among Older Adults, Medical Care, 1997; 35: 1, 031-43

16. Valle, R., Chinellato, M., Gallo, G., and Milani, L., Heart Failure in Nursing Homes: Prevalence, Hospitalization, Compliance to Guidelines, Italian Heart Journal, 2001; 2: 772-4

17. Goff, D.C. Jr., Pandey, D.K., Chan, F.A., Ortiz, C., and Nichaman, M.Z., Congestive Heart Failure in the United States: Is There More Than Meets the ICD Code? The Corpus Christi Heart Project, Archives of Internal Medicine, 2000; 160: 197-202

18. Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures Second Printing Statistics Canada Health Division Nosology Reference Centre Minister of Supply and Services, 1986, Ottawa, Canada

19. Deyo, R, A., Cherkin, D.C., and Ciol, M.A., Adapting a Clinical Comorbidity Index for use With ICD-9-CM Administrative Databases Journal of Clinical Epidemiology, 1992; 45: 613-9

20. Romano, P.S., Roos, L.L., and Jollis, J.G., Adapting a Clinical Comorbidity Index for use With ICD-9-CM Administrative Data: Differing Perspectives Journal of Clinical Epidemiology, 1993; 46: 1, 075-9

21. Polanczyk, C.A., Rohde, L.E., Philbin, E.A., and DiSalvo, T.G., A New Casemix Adjustment Index for Hospital Mortality Among Patients With Congestive Heart Failure, Medical Care, 1998; 36 (10): 1,489-99

22. Regional Health Authority Global Funding Manual, 2000-2001, in Funding Health Resourcing Branch, Alberta Health and Wellness, March 2000, Edmonton, Alberta

23. Guidelines for Management Information Systems in Canadian Health Service Organizations, Canadian Institute for Health Information, 1999 Ottawa, Ontario

24. McKillop, I., Pink, G.H., and Johnson, L.M., The Financial Management of Acute Care in Canada: A Review of Funding, Performance Monitoring and Reporting Practices Canadian Institute for Health Information, 2001, Ottawa, Ontario p 83

25. Magnus, S.A., and Smith, D.G., Better Medicare Cost Report Data are Needed to Help Hospitals Benchmark Costs and Performance Health Care Manage Rev, 2000; 25: 65-76

26. Soumerai, S.B., McLaughlin, T.J., Ross-Degnan, D., Christiansen, C.L., and Gurwitz, J.H., Effectiveness of Thrombolytic Therapy for Acute Myocardial Infarction in the Elderly: Cause for Concern in the Old-old, Archives of Internal Medicine, 2002; 162: 561-8

27. Philbin, E.F., Rocco, T.A., Jr., Lindenmuth, N.W., Ulrich, K., and Jenkins, P.L., Systolic Versus Diastolic Heart Failure in Community Practice: Clinical Features, Outcomes, and the use of Angiotensin-Converting Enzyme Inhibitors, American Journal of Medicine, 2000; 109: 605-13

28. McAlister, F.A., Teo, K.K., Taher, M., Montague, T.J., Humen, D., Cheung, L., Kiaii M., Yim, R., and Armstrong, P.W., Insights Into the Contemporary Epidemiology and Outpatient Management of Congestive Heart Failure, American Heart Journal, 1999; 138: 87-94

29. Jencks, S.F., Cuerdon, T., Burwen, D.R., Fleming, B., Houck, P.M., Kussmaul, A.E., Nilasena, D.S., Ordin, D.L., and Arday, D.R., Quality of Medical Care Delivered to Medicare Beneficiaries: A Profile at State and National Levels, JAMA, 2000; 284: 1, 670-6

30. Gottdiener, J.S., Arnold, A.M., Aurigemma, G.P., Polak, J.F., Tracy, R.P., Kitzman, D.W., Gardin, J.M., Rutledge, J.E., and Boineau, R.C., Predictors of Congestive Heart Failure in the Elderly: the Cardiovascular Health Study, Journal of the American College of Cardiology, 2000; 35: 628-37

31. Havranek, E.P., Masoud, F.A., Westfall, K.A., Wolfe, P., Ordin, D.L., and Krumholz, H.M., Spectrum of Heart Failure in Older Patients: Results From the National Heart Failure Project American Heart Journal, 2002; 143: 412-7

32. Patterns of Provincial Government Health Expenditures by Age and Gender in Alberta and Other Jurisdictions 1980-1997, Health Economics Alberta Health, March, 1998

33. Saunders, L.D., Alibhai, A., Hogan, D.B., Maxwell, C.J., Quan, H., and Johnson, D., Trends in the Utilization of Health Services by Seniors in Alberta Canadian Journal on Aging / La Revue Canadienne du Viellissement, 2001; 20: 493-516

34. Population Projections for Alberta and its Health Regions, 1996-2016, Health Surveillance, Alberta Health, Edmonton, Alberta, April, 1998

35. Rybarczyk, B., Haut, A., and Lacey, R.F., et. al., A Multifactorial Study of Age Bias Among Rehabilitation Professionals, Archives of Physical Medicine and Rehabilitation, 2001; 82: 625-32

36. Madan, A.K., Aliabadi-Wahle, S., and Beech, D.J., Age Bias: A Cause of Underutilization of Breast Conservation Treatment, Journal of Cancer Education, 2001; 16 (1): 29-32

37. Uncapher, H., and Arean, P.A., Physicians are Less Willing to Treat Suicidal Ideation in Older Patients, Journal of the American Geriatrics Society, 2000; 48: 188-92

38. Philbin, E.F., Factors Determining Angiotensin-Converting Enzyme Inhibitor Underutilization in Heart Failure in a Community Setting. Clinical Cardiology, 1998; 21: 103-8

39. Lubben, J.E., Chi, I., and Weiler, P.G., Differential Health Screening of the well Elderly by Gender and Age; Appropriate Care or Bias? Journal of Applied Gerontology, 1989; 8: 335-54

40. Levinsky, N.G., Ash, A.S., Yu, W., and Moskowitz, M.A., Patterns of use of Common Major Procedures in Medical Care of Older Adults, Journal of the American Geriatrics Society, 1999; 47: 553-8

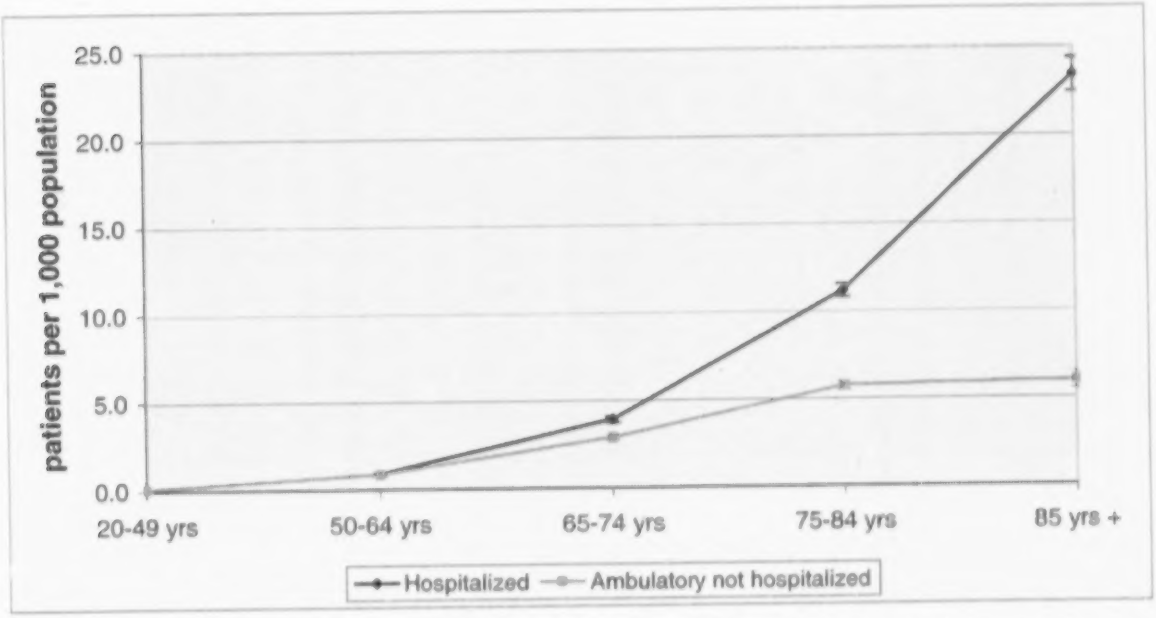
41. Smith, K.M., Lamy, A., Arthur, H.M., Gafni, and Kent, R., Outcomes and Costs of Coronary Artery Bypass Grafting, A Comparison Between Octogenarians and Septuagenarians at a Tertiary Care Centre CMAJ, 2001; 165: 759-64

42. Morgan, A., Smith, H., Simpson, I., Liddiard, G.S., Rapheal, H., Pickering, R.M., and Mant, D., Prevalence and Clinical Characteristics of Left Ventricular Dysfunction Among Elderly Patients in General Practice Setting: A Cross Sectional Survey, BMJ, 1999; 318: 368-72

43. Akosah, K.O., Moncher, K., Schaper, A., Havlik, P., and Devine, S., Chronic Heart Failure in the Community: Missed Diagnosis and Missed Opportunities, Journal of Cardiac Failure, 2001; 7: 232-8

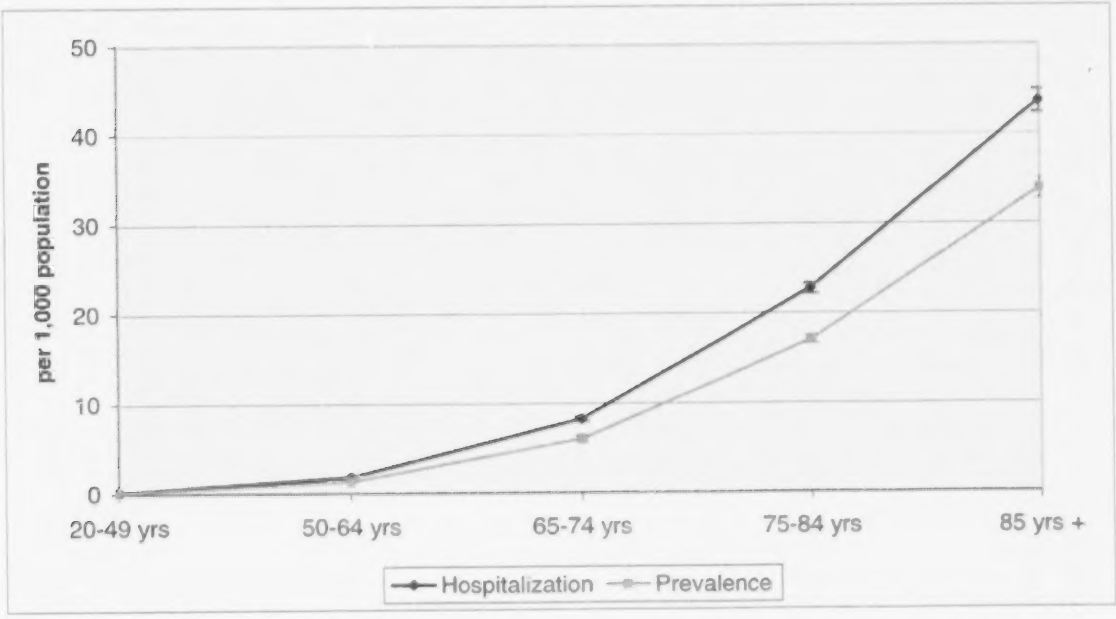
FIGURE LEGEND

Figure 1 – Age-Specific Incidence Rate for Congestive Heart Failure During April 1, 1994 to March 31, 2000



Age-specific incidence rate and ninety-nine percent confidence interval for hospitalized and ambulatory newly diagnosed congestive heart failure during April 1, 1994 to March 31, 2000.

Figure 2 – Age-Specific Prevalence Rate and Hospitalization Rate for Congestive Heart Failure During April 1, 1994 to March 31, 2000



Age-specific prevalence rate and total hospitalizations with ninety-nine percent confidence interval for hospitalized congestive heart failure during April 1, 1994 to March 31, 2000.

Table 1 – Patient Characteristics (Number and Percent) at the Time of Hospitalization for Newly Diagnosed Congestive Heart Failure in Alberta during 1994/1995 to 1999/2000

	Ages 20 to 49 n = 544	Ages 50 to 64 n = 1,956	Ages 65 to 74 n = 3,788	Ages 75 to 84 n = 5,963	Ages 85 and over n = 3,911	All ages n = 16,162
Sex: Female	235 (43.2%)	746 (38.1%)	1,650 (43.6%)	3,112 (52.2%)	2,490 (63.7%)	8,233 (50.9%)
Metropolitan Resident Regions (Calgary and Edmonton)	266 (48.9%)	887 (45.3%)	1,558 (41.1%)	2,417 (40.5%)	1,575 (40.3%)	6,703 (41.5%)
Export	91 (16.7%)	242 (12.4%)	341 (9.0%)	360 6.0%)	165 (4.2%)	1,199 (7.4%)
Hospital Size						
Rural; Less Than 200 Cases	71 (13.1%)	380 (19.4%)	805 (21.3%)	1,267 (21.2%)	921 (23.5%)	3,444 21.3%)
Rural; 200 to 646 Cases	77 (14.2%)	310 (15.8%)	757 (20.0%)	1,343 (22.5%)	876 (22.4%)	3,363 (20.8%)
Regional	75 (13.8%)	255 (13.0%)	513 (13.5%)	822 (13.8%)	496 (12.7%)	2,161 (13.4%)
Metropolitan Without Angiography	148 (27.2%)	500 (25.6%)	883 (23.3%)	1,379 (23.1%)	900 (23.0%)	3,810 (23.6%)
Metropolitan With Angiography	173 (31.8%)	511 (26.1%)	830 (21.9%)	1,152 (19.3%)	718 (18.4%)	3,384 (20.9%)

Table 2 – Patient Comorbidity and Severity of Illness (Number and Percent) at the Time of Hospitalization for Newly Diagnosed Congestive Heart Failure in Alberta During 1994/1995 to 1999/2000

	Ages 20 to 49 n = 544	Ages 50 to 64 n = 1,956	Ages 65 to 74 n = 3,788	Ages 75 to 84 n = 5,963	Ages 85 and over n = 3,911	All ages n = 16,162
Comorbidity						
None	289 (53.1%)	638 (32.6%)	1,079 (28.5%)	1,953 (32.8%)	1,619 (41.4%)	5,578 (34.5%)
One	166 (30.5%)	782 (40.0%)	1,499 (39.6%)	2,295 (38.5%)	1,415 (36.2%)	6,157 (38.1%)
More Than One	89 (16.4%)	536 (27.4%)	1,210 (31.9%)	1,715 (28.8%)	877 (22.4%)	4,427 (27.4%)
Severity						
Anemia	77 (14.2%)	238 (12.2%)	552 (14.6%)	946 (15.9%)	661 (16.9%)	2,474 (15.3%)
Electrolyte Disturbance	69 (12.7%)	167 (8.5%)	340 (9.0%)	577 (9.7%)	385 (9.8%)	1,538 (9.5%)
Coronary Artery Disease	97 (17.8%)	693 (35.4%)	1,524 (40.2%)	2,358 (39.5%)	1,318 (33.7%)	5,990 (37.1%)
Hypertension	129 (23.7%)	595 (30.4%)	1,126 (29.7%)	1,713 (28.7%)	945 (24.2%)	4,508 (27.9%)
Valvular Heart Disease	118 (21.7%)	346 (17.7%)	646 (17.1%)	964 (16.2%)	491 (12.6%)	2,565 (15.9%)
Ventricular Arrhythmia	17 (3.1%)	58 (3.0%)	128 (3.4%)	232 (3.9%)	126 (3.2%)	561 (3.5%)
Hypotension and Shock	15 2.8%)	28 (1.4%)	57 (1.5%)	107 (1.8%)	87 (2.2%)	294 (1.8%)
Severity Score (Mean, Std)	2.2 (3.2)	4.1 (3.0)	5.5 (3.0)	6.5 (3.1)	7.3 (3.2)	6.0 (3.3)

Table 3 – Selected Health Services (Number and Percent) Provided During Hospitalization and up to One Year After Hospital Admission for Congestive Heart Failure in Alberta During 1994/1995 to 1999/2000

	Ages 20 to 49 n = 544	Ages 50 to 64 n = 1,956	Ages 65 to 74 n = 3,788	Ages 75 to 84 n = 5,963	Ages 85 and over n = 3,911	All ages n = 16,162	P
Transferred to Another Acute Care Hospital	12 (2.2%)	34 (1.7%)	62 (1.6%)	74 (1.2%)	31 (0.8%)	213 (1.3%)	0.002
Special Care Unit Admission	171 (31.4%)	523 (26.7%)	822 (21.7%)	1,056 (17.7%)	399 (10.2%)	2,971 (18.4%)	0.000
Cardiac Catheterization	144 (26.5%)	460 (23.6%)	491 (13.0%)	317 (5.3%)	26 (0.7%)	1,438 (8.9%)	0.000
Percutanenous Transluminal Coronary Angioplasty / Stenting	11 (2.0%)	60 (3.1%)	65 (1.7%)	50 (0.8%)	2 (0.1%)	188 (1.2%)	0.000
Coronary Artery Bypass Surgery	9 (1.7%)	81 (4.2%)	97 (2.6%)	56 (0.9%)	3 (0.1%)	246 (1.5%)	0.000
General / Family Practitioner Listed as Most Responsible Physician	202 (37.1%)	999 (51.1%)	2,290 (60.5%)	4,170 (69.9%)	3,035 (77.6%)	10,696 (66.2%)	0.000
Any Internal Medicine Specialist Listed as Consultant Physician Or Most Responsible Physician	388 (71.3%)	1,228 (62.8%)	2,110 (55.7%)	2,993 (50.2%)	1,649 (42.2%)	8,368 (51.8%)	0.000
Any Cardiologist Specialist Listed as Consultant Physician Or Most Responsible Physician	199 (36.6%)	595 (30.4%)	909 (24.0%)	1,153 (19.3%)	456 (11.7%)	3,312 (20.5%)	0.000
Use Of Beta Blockers After Discharge [1]	NA	NA	513 (16.6%)	608 (13.0%)	204 (7.1%)	1,325 (12.5%)	0.000
Use Of ACE Inhibitors/Blocking Agents After Discharge [1]	NA	NA	1,484 (48.0%)	2,046 (43.8%)	1,065 (37.0%)	4,595 (43.2%)	0.000

[1] Includes only seniors who are enrolled in the Blue Cross pharmaceutical insurance plan

Table 4 – Unadjusted Outcomes (Number and Percent) for Those Hospitalized With Congestive Heart in Alberta During 1994/1995 to 1999/2000

	Ages 20 to 49 n = 544 n [1] = 523 n [1, 2] = 498	Ages 50 to 64 n = 1,956 n [1] = 1,885 n [1, 2] = 1,809	Ages 65 to 74 n = 3,788 n [1] = 3,584 n [1, 2] = 3,448	Ages 75 to 84 n = 5,963 n [1] = 5,373 n [1, 2] = 5,223	Ages 85 and Over n = 3,911 n [1] = 3,303 n [1, 2] = 3,187	
Mean (Std) Length of Stay in Days [1]	6.6 (6.8)	7.6 (8.2)	8.4 (9.1)	10.1 (17.1)	12.4 (21.6)	< 0.000
All cause 180-Days Readmissions n (%) [1]	67 (12.8%)	333 (17.7%)	648 (18.1%)	1,070 (19.9%)	631 (19.1%)	= 0.001
In-Hospital Mortality n (%)	21 (3.9%)	71 (3.6%)	204 (5.4%)	590 (9.9%)	608 (15.5%)	< 0.000
One-Year Mortality n (%) [1, 2]	55 (11.0%)	238 (13.2%)	680 (19.7%)	1,319 (25.3%)	1,060 (33.3%)	< 0.000
Hospital Costs per Separation (Mean, Std in Dollars) [1]	4,917 (4,037)	4,642 (3,238)	4,529 (3,447)	4,366 (2,925)	4,159 (2,521)	< 0.000
Cost per Patient per Hospital day (Mean in Dollars) [1]	1,371 (1,351)	1,097 (1,191)	958 (1,037)	856 (925)	770 (792)	< 0.000

[1] Excludes in-hospital deaths.
[2] Excludes patients who were not continuously registered in the Alberta Health Insurance Plan

Table 5 – Adjusted Outcomes (Ninety Five Percent Confidence Intervals) for Those Hospitalized With Congestive Heart in Alberta During 1994/1995 to 1999/2000

	Ages 20 to 49 n = 544 n [1] = 523 n [1, 2] = 498	Ages 50 to 64 n = 1,956 n [1] = 1,885 n [1, 2] = 1,809	Ages 65 to 74 n = 3,788 n [1] = 3,584 n [1, 2] = 3,448	Ages 75 to 84 n = 5,963 n [1] = 5,373 n [1, 2] = 5,223	Ages 85 and Over n = 3,911 n [1] = 3,303 n [1, 2] = 3,187
Length of Stay (Day) [1]	7.8 (6.4, 9.2)	8.2 (7.5, 9.0)	8.5 (8.0, 9.0)	10.0 (9.5, 10.4)	12.0 (11.5, 12.6)
Readmission Within 180-Days % [1]	14.5 (10.9, 18.0)	18.4 (16.6, 20.2)	17.8 (16.5, 19.0)	19.5 (18.4, 20.5)	19.2 (17.9, 20.6)
In-Hospital Mortality %	8.6 (5.0, 12.2)	5.6 (4.1, 7.2)	6.3 (5.3, 7.3)	9.4 (8.7, 10.0)	11.7 (11.0, 12.4)
One-Year Mortality % [1, 2]	17.9 (12.9, 22.8)	17.2 (14.9, 19.4)	21.4 (20.0, 22.9)	24.2 (23.1, 25.3)	27.6 (26.4, 28.9)
Hospital Costs per Separation (Mean in Dollars) [1]	4,846 (4,593, 5,100)	4,565 (4,430, 4,699)	4,488 (4,394, 4,582)	43,84 (4,308, 4,461)	4,229 (4,125, 4,333)
Cost per Patient per Hospital day (or Daily Cost) (Mean in Dollars) [1]	1,339 (1,252, 1,427)	1,080 (1,034, 1,127)	954 (922, 987)	861 (835, 888)	779 (743, 815)

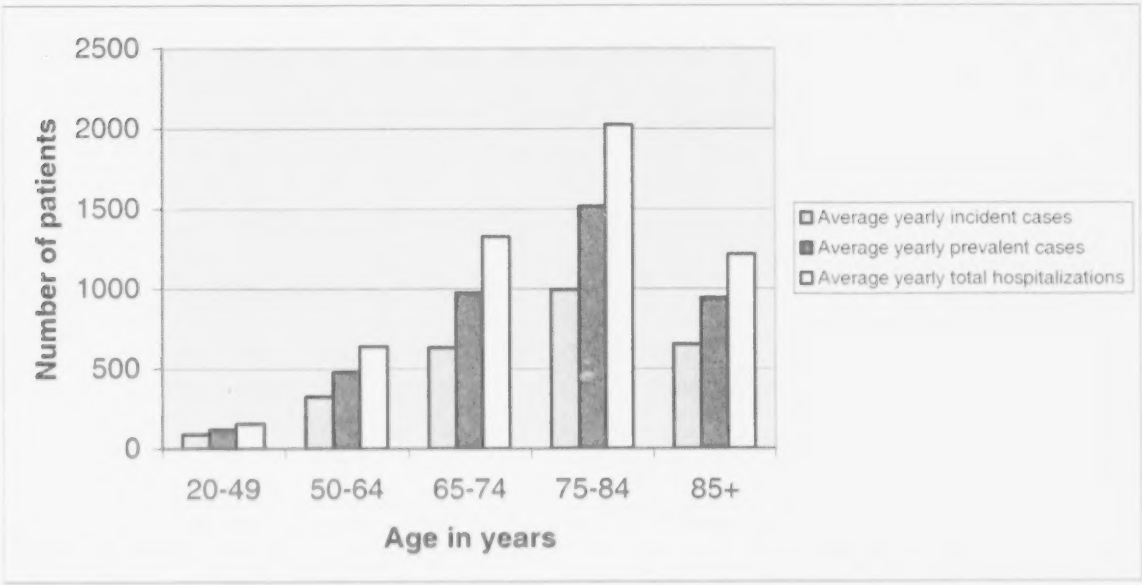
[1] Exclude in-hospital deaths
[2] Excludes patients who were not continuously registered in the Alberta Health Insurance Plan

Table 6 – Age-Specific All Cause Six-Year (From April 1, 1994 to March 31, 2000) Mortality (Percent and Ninety-Nine Percent Confidence Interval) for Newly Diagnosed Patients With Congestive Heart Failure and the General Population who Were Alive on April 1, 1994

Age Group	General Population n = 1,698,990	Ambulatory not Hospitalized Congestive Heart Failure Patients n = 1,514	Hospitalized Congestive Heart Failure Patients n = 2,466
20 to 49	(0.87-0.91) n = 1,147,411	(7.82-22.00) n = 114	(23.20-52.17) n = 69
50 to 64	5.06 (4.98-5.14) n = 306,783	(26.48-39.32) n = 307	(45.06-61.70) n = 296
65 to 74	(15.06-15.47) n = 145,356	(34.57-45.76) n = 493	(56.82-69.02) n = 650
75 to 84	35.60 (35.18-36.03) n = 75,557	(51.21-65.03) n = 468	(71.36-82.74) n = 915
85 and over	(67.73-69.84) n = 23,883	(60.91-90.61) n = 132	(80.83-96.78) n = 536

APPENDIX

Table – Age-Specific Cumulative Incidence, Prevalence and Total Hospitalizations During April 1, 1994 to March 31, 2000



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